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## (54) PRODUCTION OF ALUMINUM PLATE USING CONTINUOUS CASTING AND ROLLING APPARATUS

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a producing method for an aluminum plate having no linear flaw caused by coagulated TiB2 grain and a continuous casting and rolling apparatus for forming the aluminum plate using this producing method.
SOLUTION: In the continuous casting and rolling apparatus for forming the aluminum plate, with which molten metal is supplied into the casting and rolling means from a molten metal supplying nozzle, and cast and rolled with the casting and rolling means and the cast plate is formed, a recessed part having notch part at the upper end part in the front direction to a flowing passage, is formed on the bottom surface of the flowing passage, in which the molten metal flows to the molten metal supplying nozzle, and the coagulated TiB2 grain containing in the molten metal is deposited into the recessed part and removed.

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## CLAIMS

[Claim(s)]
[Claim 1]A manufacturing method of an aluminum plate using a continuous casting rolling mill for aluminum plate formation which has a crevice which has a notch to a flow direction on the channel bottom of an aluminum molten metal at a front upper bed part.
[Claim 2]A manufacturing method of the aluminum plate according to claim 1, wherein this crevice has a notch also in a next upper bed part to a flow direction further.
[Claim 3]A continuous casting rolling mill for aluminum plate formation having a crevice which has a notch to a flow direction on the channel bottom of an aluminum molten metal at a front upper bed part.
[Claim 4]The continuous casting rolling mill for aluminum plate formation according to claim 3, wherein this crevice has a notch also in a next upper bed part to a flow direction further.

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the manufacturing method of an aluminum plate and the continuous casting rolling mill for aluminum plate formation which use the continuous casting rolling mill for aluminum plate formation.
[0002]
[Description of the Prior Art]The continuous casting rolling mill is used for manufacture of the base material for planography blocks of a photosensitive planographic printing plate.
As indicated by JP,8-49034,A and JP,8-73974,A, it is a device which supplies the molten metal of an aluminum alloy between the roll kneaders of a couple from a molten metal feeding nozzle, carries out casting rolling of said molten metal by rotation of the roll kneader of a couple, and forms a cast metal plate.
However, with the continuous casting rolling mill of a statement, to JP,8-49034,A or JP,8-73974,A. It is easy to condense the particles of $TiB_2$ added by the molten metal of an aluminum alloy as crystal minuteness making material on the way, and there is a problem that a muscle occurs intermittently on the surface of a cast metal plate by the particles of this condensed $TiB_2$. When the quality of a cast metal plate manufactures a photosensitive planographic printing plate, they are important requirements, and since this muscle will surface notably and will pose a problem if mechanical surface roughening, chemical surface roughening, or electrochemical surface roughening is performed especially, it needs to prevent generating of a muscle. On the other hand, although the molten metal was passed to the ceramic tube filter and the particles of $TiB_2$ are removed in JP,60-230944,A or a device given in Japanese Patent Application No. 8-207222, Since the probability that the particles of big and rough $TiB_2$ will pass through the crevice between ceramic tube filters will increase if prolonged operation is performed, it does not become fundamental solution. In not adding $TiB_2$ as crystal minuteness making material, cast structure becomes uneven, and a mechanical strength varies, or it becomes easy to generate a streak, and the fault of spoiling the appearance of a board arises.
[0003]
[Problem(s) to be Solved by the Invention]Therefore, an object of this invention is to provide the continuous casting rolling mill for aluminum plate formation used for the manufacturing method and this manufacturing method of an aluminum plate without the muscle resulting from the condensed $TiB_2$ particles.
[0004]
[Means for Solving the Problem]In a continuous casting rolling mill for aluminum plate formation which the above-mentioned purpose supplies a molten metal to a casting rolling means from a molten metal feeding nozzle, carries out casting rolling of said molten metal in said casting rolling means, and forms a cast metal plate, A crevice where said molten metal has a notch to a channel at an upper bed part of front on the bottom of a channel through which it flows to said molten metal feeding nozzle is formed, It is attained by a manufacturing method and this device of an aluminum plate using a continuous casting rolling mill for aluminum plate formation making said crevice sediment and removing condensed $TiB_2$ particles which are contained in said molten metal.
[0005]According to this invention, when a molten metal flows to a molten metal feeding nozzle along a channel, condensed $TiB_2$ particles which are contained in a molten metal sediment to a crevice formed in the bottom of a channel, and are removed in it. At this time, condensed $TiB_2$ particles in a molten metal are easily and certainly removable by forming a notch in an upper bed part of crevice front to a flow direction of a molten metal, and. $TiB_2$ particles can be prevented from gathering and condensing in a stagnation part by controlling stagnation produced near a crevice entrance. Although it does not have a notch, but $TiB_2$ particles which a wall surface of a crevice condensed to the channel bottom also when vertical sediment to a crevice and myogenesis of an aluminum plate by mixing of $TiB_2$ particles decreases, If prolonged operation is performed and a casting throughput increases, mixing to an aluminum plate of particles of $TiB_2$ will take place, and a muscle will occur too. $TiB_2$ particles condense this in a stagnation part produced near a crevice entrance, and it is considered to be for flowing out downstream, when a flow of a molten metal is confused. By having a notch also in an upper bed part of the direction of crevice back to a flow direction, also when a molten metal is processed in large quantities, $TiB_2$ particles condensed still more certainly are removed, and it is desirable. Since $TiB_2$ particles condensed by using a continuous casting rolling mill for aluminum plate formation of this invention are not supplied to a casting rolling means and a muscle of a $TiB_2$ reason does not occur in a cast metal plate, a high photosensitive planographic printing plate of surface quality can be manufactured.

[0006]
[Embodiment of the Invention]According to an accompanying drawing, it explains in full detail about the desirable embodiment of the continuous casting rolling mill concerning this invention below. Drawing 1 is an explanatory view showing the entire configuration of the continuous casting rolling mill of this embodiment. As shown in the figure, the continuous casting rolling mill 10 is mainly provided with the melting holding furnace 12, the guttering 14, the molten metal feeding nozzle 16, the rotary rollers 18 and 18 of a couple, and the coiler 20. The molten metal 22 in which the ingot of the aluminum alloy was dissolved is accumulated in the melting holding furnace 12. The melting holding furnace 12 is provided with the melting holding furnace tilting machine 24, it is tilted by the electrical-motor drive of the melting holding furnace tilting machine 24, and the molten metal 22 accumulated in the melting holding furnace 12 is poured into the guttering 14. The crevice 30 which has the notch mentioned later is formed in the bottom of the guttering 14 in which the molten metal 22 is poured in. The level indicator 32 which detects the liquid level in the guttering 14 is formed in the guttering 14, and this level indicator 32 is connected to the melting holding furnace tilting machine 24 via the control device 34. The control device 34 controls the melting holding furnace tilting machine 24 based on the detection liquid level of the level indicator 32, and adjusts the liquid level in the guttering 14.
[0007]The molten metal feeding nozzle 16 is formed in the figure Nakamigi end of said guttering 14, and carries out the regurgitation of the molten metal 22 in the guttering 14 in the direction of figure Nakamigi. The rotary rollers 18 and 18 of a couple are allocated in figure Nakagami down on both sides of the tip part of the molten metal feeding nozzle 16, they carry out casting rolling of the molten metal 22 breathed out from the molten metal feeding nozzle 16 by the rotation, and form the cast metal plate 36, and they pinch and convey the formed cast metal plate 36. The coiler 20 rolls round the cast metal plate 36 conveyed by the rotary rollers 18 and 18 of a couple. The cutting machine 38 may cut the cast metal plate 36 if needed.
[0008]Drawing 2 is an expansion perspective view showing some gutterings 14 which form the crevice 30 which has the notch shown in drawing 1. As shown in the figure, the 1st fire-resistant member 42 and the 2nd fire-resistant member 44 are put together, and the crevice 30 which has a notch is formed. Drawing 3 is some front views of the guttering 14 shown in drawing 2, and drawing 4 is four to 4 sectional view of drawing 3. The 1st fire-resistant member 42 and the 2nd fire-resistant member 44 are formed in the concave which has a notch, and the screw-thread holes 46, 46, and 46 are formed in each position which counters. The bolts 47, 47, and 47 are screwed in each screw-thread holes 46, 46, and 46, and the 1st fire-resistant member 42 and the 2nd fire-resistant member 44 are concluded. The slot 43 which has a notch is formed in the upper part where the left end side in drawing 4 was blockaded by the 1st fire-resistant member 42, and the slot 45 where the drawing 4 Nakamigi end face was blockaded is formed in the 2nd fire-resistant member 44. The crevice 30 which the slot 43 and the slot 45 are put together, and has a notch is formed. The structure of a crevice is not limited to the structure of drawing 2, 3, and 4 statement, but as long as it fulfills the main point of this application, it may use the thing of what kind of structure.
[0009]As for the shape of the notch in 4-4 sectional view shown in drawing 4, it is preferred that notch height is not less than 10 mm, and notch width is not less than 5 mm. Notch height is lower than 10 mm, or when notch width is smaller than 5 mm, a muscle occurs in an aluminum plate. In a molten metal, to a flow direction, the front part wall side of a crevice is collided with, stagnation occurs, or an eddy style occurs, and this is considered for sedimentation of condensation $TiB_2$ particles not to fully take place. By having a notch also in the back upper bed part of a crevice to a flow direction, impurities, such as $TiB_2$ particles which carried out full condensation further, can be removed, and it is desirable. It is preferred that notch height is not less than 10 mm, and notch width is not less than 5 mm as shape of the notch of the back upper bed part of this. As for the depth (height from a crevice low surface part to a channel base part) of a crevice, in the overall shape of a crevice of having a notch, it is preferred that it is 2 to 5 times the depth of a channel. Since a device becomes large too much and removal of the molten metal after the end of casting is difficult when the depth of a crevice exceeds 5 times of the depth of a channel, it is not realistic. When the depth of a crevice is shallow, including big and rough $TiB_2$ particles, re-surfacing of various impurities takes place easily, and generating of the muscle of a cast metal plate takes place. As for the opening length (longest portion of the crevice opening in a flow direction) of the flow direction of a crevice, it is preferred that it is 1 to 10 times the depth of a channel. Molten metal (aluminum) which a device will become large too much and will remain in the crevice after the end of casting if the opening length of a crevice exceeds 10 times Since a lost part increases, it is not realistic. Sufficient sedimentation of the $TiB_2$ particles condensed when opening length was not long enough does not take place, but generating of the muscle of a cast metal plate takes place.
[0010]Drawing 5 is an explanatory view showing the composition of the cold rolling mill 50. The cold rolling mill 50 comprises the work rolls 56 and 56 of the couple which was provided between the coil sending machine 52 and the coil winder 54, and was provided on both sides of the cast metal plate 36, and the back up roll 58 ****(ed) by the work rolls 56 and 56 of the couple. As for the board 36 with which even the coil winder 54 is conveyed from the coil sending machine 52, cold rolling is performed by rotation of the work rolls 56 and 56 of a couple. An intermediate roll may be formed between the back up roll and a work roll, and the back up roll and two or more intermediate rolls may be formed.
[0011]Drawing 6 is an explanatory view showing the composition of the continuous-annealing device 60. The continuous-annealing device 60 is formed between the sending machine 62 and the winder 64, and heat treatment is performed when the cold-rolled board with which even the winder 64 is conveyed from the sending machine 62 passes the continuous-annealing device 60. Drawing 7 is an explanatory view showing the composition of the batch-annealing device 70. The batch-annealing device 70 is provided with the support plate 72 and the stoppers 74 and 74 of the couple provided in the figure Nakagami side. It is cold-rolled with the cold rolling mill of drawing 5, the rolled-round coil is laid in the support plate 72, and heat treatment is performed.

[0012]Drawing 8 is an explanatory view showing the composition of the orthodontic appliance 80. the orthodontic appliance 80 is formed between the sending machine 82 and the winder 84 -- two or more correction rollers 86 and 86 ... is provided in accordance with the conveyance course of a board. The boards with which even the winder 64 is conveyed from the sending machine 62 are two or more correction rollers 86 and 86, being able to give tension between a sending machine and a winder... The core set is corrected by rotation.
[0013]Next, an operation of the constituted continuous casting rolling mill is explained like the above. The melting holding furnace 12 of drawing 1 holds the molten metal 22 in which the ingot of the aluminum alloy was dissolved. The level indicator 32 detects the liquid level in the guttering 14, and the control device 34 controls the melting holding furnace tilting machine 24 based on this detection liquid level, **** the holding furnace 12 by electrical-motor drive, and it pours the molten metal 22 in the melting holding furnace 12 into the guttering 14.
[0014]The molten metal 22 poured in into the guttering 14 flows in the direction of figure Nakamigi, and is breathed out between the rotary rollers 18 and 18 of a couple from the molten metal feeding nozzle 16. Although the detailed particles of $TiB_2$ contained in the molten metal 22 are distributed in a molten metal at this time, it is incorporated into a cast metal plate through the nozzle 16 and an operation of crystal minuteness making is shown, big and rough particles sediment and a bottom is easily covered with them. To the specific gravity 2.7 of aluminum, since the specific gravity of $TiB_2$ is as large as 4.5, especially big and rough particles sediment to the crevice 30 which has a notch, and separation removal is easy to be carried out from aluminum. In addition, since stagnation does not produce easily the crevice which has a notch near [ the ] an entrance, it does not happen easily that detailed particles remain in a stagnation part and condense. Therefore, big and rough $TiB_2$ particles are not breathed out between the rotary rollers 18 and 18 of a couple from the molten metal feeding nozzle 16.
[0015]The rotary rollers 18 and 18 of a couple carry out casting rolling of the molten metal breathed out from the molten metal feeding nozzle 16 by the rotation, and form the cast metal plate 36. Since big and rough $TiB_2$ leading to the myogenesis does not mix at this time, the high cast metal plate 36 of surface quality without a muscle can be obtained. The rotating rotary rollers 18 and 18 of a couple carry out pinching conveyance of the cast metal plate 36, and are rolled round by the coiler 20. The cutting machine 38 may cut to fixed length if needed.
[0016]Next, it cold-rolls to the cast metal plate 36 rolled round by the coiler 20 with the cold rolling mill 50 shown in drawing 5, and heat-treats with the batch-annealing device 70 shown in the continuous-annealing device 60 or drawing 7 shown in drawing 6. Cold rolling and heat treatment are performed for equalization and flattening of the organization of the cast metal plate 36, and intensity control to accumulate, and only either may be performed if needed. In performing both cold rolling and heat treatment, it makes 0.5-3-mm thickness to the cast metal plate 36 by which casting rolling was carried out at 0.1-0.5-mm thickness. In not heat-treating, it makes 0.1-0.5-mm thickness only with cold rolling. When using the continuous-annealing device 60 for heat treatment, it is 1-600 at 400 to 600 ″. In using a second deed and the batch-annealing device 70, it carries out at 300-600 degrees for 1 to 12 hours.
[0017]Subsequently, the smoothness of a rolled plate is corrected with the orthodontic appliance 56 shown in drawing 8. then, mechanical or electric in the surface of the cast metal plate 36 -- or surface roughening is carried out chemically or electrochemically, and the base material for planography blocks is made. Image exposure of the photosensitive coat is provided and carried out to this base material for planography blocks, it is developed to it, it engraves to it, and a photosensitive planographic printing plate is completed. This photosensitive planographic printing plate can be manufactured with high quality with improvement in the surface quality of the cast metal plate 36.
[0018]
[Example]Hereafter, an example explains this invention concretely. Continuous casting rolling of the cast metal plate 36 was carried out as follows using the continuous casting rolling mill 10 shown in drawing 1. first, the melting holding furnace 12 -- Fe:0.30 weight % (the following -- the same) The molten metal 22 was adjusted so that it might become the remaining aluminum and an inevitable impurity Si:0.05% and Cu:0.01%, and it maintained to 775 **. Lean the melting holding furnace 12, fill the guttering 14 with the molten metal 22, and it was made to breathe out between the rotary rollers 18 and 18 of a couple from the molten metal feeding nozzle 16, and continuous casting rolling of 7.0-mm-thick cast metal plate B6 was carried out, solidifying and cooling between the rotary rollers 18 and 18.Under the present circumstances, the molten metal 22 of the guttering 14 is supplied by making the alloy wire 23 of aluminum-Ti(5%)-B (1%) into a crystal minuteness making agent, and the speed of supply was set up and it was made to dissolve so that the Ti concentration in the molten metal 22 may be 0.01%. Drawing 9 is a figure showing the experimental result which compared the surface quality of the cast metal plate 36 in each casting throughput at the time of changing various shape of the crevice 30. In Example 1, continuous casting was performed in the upper bed part in front of the flow direction of a low surface part [ channel ] using the guttering in which the crevice which has a notch was formed. In Example 2, continuous casting was performed before a flow direction and at the Gokami end using the crevice which has a notch. The example which cast using the guttering which formed the crevice without a notch as the comparative example 1 was shown. The example which cast using the guttering with a flat channel base part in which the crevice is not formed as the comparative example 2 was shown. The outline dimensions of the device of an example and a comparative example are as follows.
[0019]
[Table 1]
channel Crevice Crevice pars basilaris ossis occipitalis Front notch The back notch depth . Depth Length Height x width Height x width example 1 30mm 60mm 30mm 20x10mm - Example 2 30mm 60mm 30mm 20x10mm 20x10mm comparative example 1 30mm 60mm 30mm - - comparative example 2 30 mm - - - -[0020]During casting, the melt surface level of the guttering 14 was measured with the level indicator 32, the melting holding furnace tilting machine 24 of the melting holding furnace 12 was controlled via the control device 34, and the amount of supply of the molten metal was fixed. The

sample produced in this way was rolled round by the coiler 20, and it cut suitably with the cutting machine 38, and was considered as the sample web. Subsequently, each sample web was cold-rolled to 1.5-mm thickness with the cold rolling mill 50 shown in drawing 5, and it heat-treated by annealing for 10 hours by 480 ** with the batch type annealing device 70 shown in drawing 7. And each cast metal plate 36 was again cold-rolled with the cold rolling mill 50 shown in drawing 5, and 0.24-mm thickness was made.

[0021]Next, in order to check the level of the muscle of Ti reason, after performing alkali etching processing for 30 seconds for each board to which 0.24-mm thickness was made at 60 ** using sodium aluminate (aluminum$^{3+}$ 10%:NaOH30%) liquid, a sulfuric acid solution performs DESUMATTO -- nitric acid ****** -- surface roughening was carried out electrochemically. It was evaluated whether the muscle would have occurred to each board in the state. As a result, it is although a muscle is not accepted to 400 kg of throughputs in Example 1 (O), (** to which the muscle was accepted a little when 1000 kg was processed). In Example 2 which uses the guttering in which the crevice which has a notch was formed also in the upper bed part after a flow direction, the muscle was not accepted in which throughput. (x) to which the muscle was clearly accepted when the throughput increased more than this although a muscle was not accepted at 100 kg of throughputs in the comparative example 1 which uses the guttering which has a crevice which does not have a notch . In the comparative example 2 which uses the guttering which does not have a crevice, the muscle was clearly accepted also in which throughput.

[0022]It is EPMA (an electron probe microanalyzer, JEOL JXA-8800M) to the cast metal plate 36 of the comparative examples 1 and 2. When surface analysis was conducted, it was checked that $TiB_2$ is carrying out segregation to the generated muscle. The impurity which will be believed to be the wreckage of the molten metal 22 in the crevice 30 if the molten metal 22 is discharged from the guttering 14 and the crevice 30 after the above-mentioned foundry practice is completed existed, when the impurity was analyzed, $TiB_2$ was detected at high concentration, and it checked that big and rough $TiB_2$ particles were sedimenting to the crevice. In the comparative example 1, since the wall surface in front of the flow direction of a crevice is vertical, a molten metal collides with this wall surface, and with a flow, since generating or an eddy style occurs, stagnation, Big and rough $TiB_2$ (impurity) Since it was not fully able to sediment and $TiB_2$ which stagnated in stagnation condensed and big and rough $TiB_2$ particles were formed, it is thought that the muscle occurred. As for the shape of each crevice 30 of Examples 1 and 2, this result shows that $TiB_2$ particles sediment easilier than the crevice 30 of the shape of the comparative example 1.

[0023]

[Effect of the Invention]In this invention, an aluminum plate is formed in the bottom of a channel using this device about aluminum plate formation ****** casting pressure ****** which has an upper bed part in front of a flow direction, and a crevice which has a notch also in a next upper bed part still more preferably.

Therefore, since it can avoid mixing in a cast metal plate the big and rough $TiB_2$ particles contained in a molten metal, an aluminum plate without a muscle can be manufactured.

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## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is an explanatory view showing the entire configuration of the continuous casting rolling mill of this embodiment.
[Drawing 2]It is an expansion perspective view showing some gutterings which form the crevice shown in drawing 1.
[Drawing 3]They are some front views of the guttering shown in drawing 2.
[Drawing 4]It is a sectional view which meets four to 4 line of drawing 3.
[Drawing 5]It is an explanatory view of a cold rolling mill.
[Drawing 6]It is an explanatory view of a continuous-annealing device.
[Drawing 7]It is an explanatory view of a batch-annealing device.
[Drawing 8]It is an explanatory view of the orthodontic appliance.
[Drawing 9]It is a figure showing the experimental result which compared the surface quality of the cast metal plate at the time of changing the shape of a crevice.
[Description of Notations]
10 -- Continuous casting rolling mill
12 -- Melting holding furnace
14 -- Guttering
16 -- Molten metal feeding nozzle
18 -- Rotary roller
22 -- Molten metal
30 -- Crevice
36 -- Cast metal plate

[Translation done.]

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(54)【発明の名称】　連続鋳造圧延装置を用いるアルミニウム板の製造方法

(57)【要約】

【課題】　凝集した$TiB_2$粒子に起因する筋のないアルミニウム板の製造方法及び該製造方法に用いるアルミニウム板形成用連続鋳造圧延装置を提供すること。

【解決手段】　溶湯を溶湯供給ノズルから鋳造圧延手段に供給し、前記鋳造圧延手段にて前記溶湯を鋳造圧延して鋳造板を形成するアルミニウム板形成用連続鋳造圧延装置において、前記溶湯が前記溶湯供給ノズルまで流れる流路の底面に、流路に対して前方向の上端部に切欠を有する凹部を形成して、前記溶湯に含まれる凝集した$TiB_2$粒子を前記凹部に沈降させて除去することを特徴とするアルミニウム板形成用連続鋳造圧延装置を用いてアルミニウム板を製造する。

【特許請求の範囲】

【請求項１】　アルミニウム溶湯の流路底面に、流れ方向に対して前の上端部に切欠を有する凹部を有するアルミニウム板形成用連続鋳造圧延装置を用いることを特徴とする、アルミニウム板の製造方法。

【請求項２】　該凹部がさらに流れ方向に対して後の上端部にも切欠を有することを特徴とする、請求項１に記載のアルミニウム板の製造方法。

【請求項３】　アルミニウム溶湯の流路底面に、流れ方向に対して前の上端部に切欠を有する凹部を有することを特徴とする、アルミニウム板形成用連続鋳造圧延装置。

【請求項４】　該凹部がさらに流れ方向に対して後の上端部にも切欠を有することを特徴とする、請求項３に記載のアルミニウム板形成用連続鋳造圧延装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、アルミニウム板形成用連続鋳造圧延装置を用いるアルミニウム板の製造方法及びアルミニウム板形成用連続鋳造圧延装置に関する。

【０００２】

【従来の技術】連続鋳造圧延装置は、感光性平版印刷版の平版印刷版用支持体の製造に用いられており、特開平8-49034 号公報や特開平8-73974 号公報に開示されるように、アルミニウム合金の溶湯を溶湯供給ノズルから一対の回転ロール間に供給して、一対の回転ロールの回転によって前記溶湯を鋳造圧延して鋳造板を形成する装置である。しかしながら、特開平8-49034 号公報や特開平8-73974 号公報に記載の連続鋳造圧延装置では、アルミニウム合金の溶湯に結晶微細化材として添加される$TiB_2$の粒子が途中で凝集しやすく、この凝集した$TiB_2$の粒子によって鋳造板の表面に筋が断続的に発生するという問題がある。鋳造板の良否は感光性平版印刷版を製造する上で重要な要件であり、特に、機械的な粗面化、化学的な粗面化、あるいは電気化学的粗面化を行うと、この筋が顕著に表面化して問題となるため、筋の発生を防止する必要がある。これに対して、特開昭60-230944 号公報や特願平8-207222に記載の装置では、溶湯をセラミックチューブフィルターに通過させて$TiB_2$の粒子を除去しているが、長時間運転を行うとセラミックチューブフィルタの隙間を粗大な$TiB_2$の粒子がすり抜ける確率が増加するため、根本的な解決にはならない。また、結晶微細化材として$TiB_2$を添加しない場合には、鋳造組織が不均一になり、機械的強度がばらついたり、ストリークが発生しやすくなり、板の外観を損ねるという不具合が生じる。

【０００３】

【発明が解決しようとする課題】従って、本発明は、凝集した$TiB_2$粒子に起因する筋のないアルミニウム板の製造方法及び該製造方法に用いるアルミニウム板形成用連続鋳造圧延装置を提供することを目的とする。

【０００４】

【課題を解決する為の手段】上記目的は、溶湯を溶湯供給ノズルから鋳造圧延手段に供給し、前記鋳造圧延手段にて前記溶湯を鋳造圧延して鋳造板を形成するアルミニウム板形成用連続鋳造圧延装置において、前記溶湯が前記溶湯供給ノズルまで流れる流路の底面に、流路に対して前方向の上端部に切欠を有する凹部を形成して、前記溶湯に含まれる凝集した$TiB_2$粒子を前記凹部に沈降させて除去することを特徴とするアルミニウム板形成用連続鋳造圧延装置を用いるアルミニウム板の製造方法及び該装置により達成される。

【０００５】本発明によれば、溶湯が流路に沿って溶湯供給ノズルまで流れる際に、溶湯に含まれる凝集した$TiB_2$粒子が、流路の底面に形成された凹部に沈降し、除去される。この時、溶湯の流れ方向に対して、凹部前方向の上端部に切欠を形成することにより、溶湯中の凝集した$TiB_2$粒子を容易に且つ確実に除去することができると共に、凹部入口付近に生じる滞留を抑制することで、滞留部に$TiB_2$粒子が集まって凝集することを防止できる。切欠を有せず、凹部の壁面が流路底面に対して垂直である場合にも、凝集した$TiB_2$粒子は凹部へ沈降し、$TiB_2$粒子の混入によるアルミニウム板の筋発生は減少するが、長時間運転を行い、鋳造処理量が多くなると、$TiB_2$の粒子のアルミニウム板への混入が起こり、筋がやはり発生する。これは、凹部入口付近に生じる滞留部に$TiB_2$粒子が凝集し、溶湯の流れが乱れた時に下流に流れ出すためであると考えられる。また、流れ方向に対して凹部後ろ方向の上端部にも切欠を有することにより、大量に溶湯を処理した場合にもさらに確実に凝集した$TiB_2$粒子が除去され、好ましい。本発明のアルミニウム板形成用連続鋳造圧延装置を用いることにより、凝集した$TiB_2$粒子が鋳造圧延手段に供給されないため、鋳造板に$TiB_2$起因の筋が発生しないので、表面品質の高い感光性平版印刷版を製造することができる。

【０００６】

【発明の実施の形態】以下添付図面に従って、本発明に係る連続鋳造圧延装置の好ましい実施の形態について詳説する。図１は、本実施の形態の連続鋳造圧延装置の全体構成を示す説明図である。同図に示すように、連続鋳造圧延装置10は、主として溶解保持炉12、樋14、溶湯供給ノズル16、一対の回転ローラ18、18、及びコイラー20を備えている。溶解保持炉12には、アルミニウム合金のインゴットが溶解された溶湯22が溜められる。溶解保持炉12は溶解保持炉傾動機24を備えており、溶解保持炉傾動機24の電動モーター駆動によって傾動され、溶解保持炉12内に溜められた溶湯22が樋14に注入される。溶湯22が注入される樋14の底面には、後述する切欠を有する凹部30が形成されている。また、樋14には樋14内の液位を

検出するレベル計32が設けられ、このレベル計32は、制御装置34を介して溶解保持炉傾動機24に接続されている。制御装置34は、レベル計32の検出液位に基づいて溶解保持炉傾動機24を制御して樋14内の液位を調整する。

【０００７】溶湯供給ノズル16は、前記樋14の図中右端に設けられ、樋14内の溶湯22を図中右方向に吐出する。一対の回転ローラ18、18は、溶湯供給ノズル16の先端部を挟んで図中上下方向に配設され、溶湯供給ノズル16から吐出された溶湯22をその回転によって鋳造圧延して鋳造板36を形成すると共に、形成された鋳造板36を挟持して搬送する。コイラー20は、一対の回転ローラ18、18によって搬送される鋳造板36を巻き取る。また、必要に応じて切断機38によって鋳造板36を切断してもよい。

【０００８】図２は、図１に示された切欠を有する凹部30を形成する樋14の一部を示す拡大斜視図である。同図に示すように、切欠を有する凹部30は第１の耐火部材42と第２の耐火部材44とが組み合わされて形成される。図３は図２に示された樋14の一部の正面図であり、図４は図３の４－４断面図である。第１の耐火部材42と第２の耐火部材44とは切欠を有する凹状に形成され、ねじ孔46、46、46が各々の対向する位置に形成される。各ねじ孔46、46、46にはボルト47、47、47が螺合され、第１の耐火部材42と第２の耐火部材44とが締結される。第１の耐火部材42には図４中左端面が閉塞された上部に切欠を有する溝43が形成され、第２の耐火部材44には図４中右端面が閉塞された溝45が形成される。溝43と溝45とは合わさって切欠を有する凹部30が形成される。凹部の構造は図２、３、４記載の構造には限定されず、本願の主旨を満たせばどのような構造のものを用いてもよい。

【０００９】図４に示される４－４断面図における切欠部の形状は、切欠部高さが10mm以上であり、切欠部幅が5mm 以上であることが好ましい。切欠部高さが10mmより低いか、又は切欠部幅が5mm より小さい場合には、アルミニウム板に筋が発生する。これは溶湯が、流れ方向に対して凹部の前部壁面にぶつかり、淀みが発生したり、うず流が発生して、凝集$TiB_2$粒子の沈降が十分に起こらないためと考えられる。また、流れ方向に対して凹部の後ろ上端部にも切欠を有することにより、さらに完全凝集した$TiB_2$粒子等の不純物の除去を行うことができ、好ましい。この後ろ上端部の切欠部の形状としては、切欠部高さが10mm以上であり、切欠部幅が5mm 以上であることが好ましい。切欠を有する凹部の全体的な形状において、凹部の深さ（凹部低面部から流路底面部までの高さ）は流路の深さの２～５倍であることが好ましい。凹部の深さが流路の深さの５倍を超える場合は、装置が大きくなりすぎ鋳造終了後の溶湯の除去がむずかしいので、現実的ではない。また、凹部の深さが浅い場合には粗大な$TiB_2$粒子を含め、種々の不純物の再浮上が起こりやすく、鋳造板の筋の発生が起こる。また、凹部の流れ方向の開口部長さ（流れ方向における凹部開口部の最長部分）は流路の深さの１～１０倍であることが好ましい。凹部の開口部長さが１０倍を超えると装置が大きくなりすぎ鋳造終了後の凹部に残る溶湯（アルミ）のロス分が多くなるため現実的ではない。また、開口部長さが十分長くないと凝集した$TiB_2$粒子の十分な沈降が起こらず、鋳造板の筋の発生が起こる。

【００１０】図５は、冷間圧延機50の構成を示す説明図である。冷間圧延機50は、コイル送出し機52とコイル巻取り機54との間に設けられ、鋳造板36を挟んで設けられた一対のワークロール56、56と、一対のワークロール56、56に転接されたバックアップロール58とから構成される。コイル送出し機52からコイル巻取り機54まで搬送される板36は、一対のワークロール56、56の回転によって冷間圧延が行われる。尚、バックアップロールとワークロールの間に中間ロールを設けてもよいし、バックアップロールや中間ロールを複数本、設けてもよい。

【００１１】図６は、連続焼鈍装置60の構成を示す説明図である。連続焼鈍装置60は、送り出し機62と巻取り機64との間に設けられ、送出し機62から巻取り機64まで搬送される冷間圧延済の板は、連続焼鈍装置60を通過する際に熱処理が行われる。図７は、バッチ焼鈍装置70の構成を示す説明図である。バッチ焼鈍装置70は、支持板72とその図中上面に設けられた一対のストッパー74、74とを備えている。図５の冷間圧延機で冷間圧延され、巻取られたコイルは、支持板72に載置されて熱処理が行われる。

【００１２】図８は、矯正装置80の構成を示す説明図である。矯正装置80は、送出し機82と巻取り機84との間に設けられ、複数の矯正ローラ86、86･･･ が板の搬送径路に沿って設けられる。送出し機62から巻取り機64まで搬送される板は、送出し機、巻取り機間で張力を与えられながら複数の矯正ローラ86、86･･･ の回転によってその巻き癖が矯正される。

【００１３】次に、上記の如く構成された連続鋳造圧延装置の作用について説明する。図１の溶解保持炉12は、アルミニウム合金のインゴットが溶解された溶湯22を保持する。レベル計32は樋14内の液位を検出し、制御装置34は該検出液位に基づいて溶解保持炉傾動機24を制御して保持炉12を電動モーター駆動によって傾勤して、溶解保持炉12内の溶湯22を樋14に注入する。

【００１４】樋14内に注入された溶湯22は図中右方向に流れて、溶湯供給ノズル16から一対の回転ローラ18、18間に吐出される。この時、溶湯22に含まれる$TiB_2$の微細な粒子は溶湯中に分散して、ノズル16を経て鋳造板に取り込まれ、結晶微細化の作用を示すが、粗大な粒子は沈降して底にたまりやすい。Alの比重2.7 に対して、$TiB_2$は、その比重が4.5 と大きいため、特に粗大な粒子は切欠を有する凹部30に沈降してAlから分離除去されやすい。加えて、切欠を有する凹部は、その入口付近で滞留が生じにくいので、微細な粒子が滞留部にとどまり凝集

することが起こりにくい。従って、粗大な$TiB_2$粒子は溶湯供給ノズル16から一対の回転ローラ18、18間に吐出されない。

【００１５】一対の回転ローラ18、18は、溶湯供給ノズル16から吐出された溶湯をその回転によって鋳造圧延して鋳造板36を形成する。この時、筋発生の原因となる粗大な$TiB_2$が混入しないため、筋のない表面品質の高い鋳造板36を得ることができる。回転する一対の回転ローラ18、18は鋳造板36を挟持搬送して、コイラー20に巻き取られる。また必要に応じて切断機38によって一定の長さに切断してもよい。

【００１６】次に、コイラー20に巻き取られた鋳造板36に対して、図５に示す冷間圧延機50によって冷間圧延を行い、図６に示す連続焼鈍装置60又は図７に示すバッチ焼鈍装置70によって熱処理を行う。冷間圧延と熱処理は、鋳造板36の組織の均一化と平坦化、及び強度コントロールのために行われ、必要に応じて何れか一方のみを行ってもよい。冷間圧延と熱処理を両方行う場合には0.5 〜３mm厚に鋳造圧延された鋳造板36を0.1 〜0.5mm 厚に仕上げる。熱処理を行わない場合には、冷間圧延のみで0.1 〜0.5mm 厚に仕上げる。熱処理に連続焼鈍装置60を使用する場合には400 〜 600°で１〜600 秒行い、バッチ焼鈍装置70を使用する場合には300 〜600°で１〜12時間行う。

【００１７】次いで、図８に示す矯正装置56で圧延板の平面性を矯正する。その後、鋳造板36の表面を機械的、或いは電気的、或いは化学的、或いは電気化学的に粗面化して、平版印刷版用支持体に仕上げる。この平版印刷版用支持体に感光性塗膜を設け、画像露光し、現像して＊

＊製版し、感光性平版印刷版が完成する。この感光性平版印刷版は、鋳造板36の表面品質の向上に伴い、高品質に製造することができる。

【００１８】

【実施例】以下、本発明を実施例によって具体的に説明する。図１に示す連続鋳造圧延装置10を用いて、次のように鋳造板36を連続鋳造圧延した。まず、溶解保持炉12でFe:0.30 重量% （以下同様）、Si:0.05%、Cu:0.01%、残りAlと不可避不純物となるように溶湯22を調整し、775 ℃に維持した。溶解保持炉12を傾けて、樋14に溶湯22を注ぎ、溶湯供給ノズル16から一対の回転ローラ18、18間に吐出させ、回転ローラ18、18間で凝固・冷却しながら厚さ7.0mm の鋳造板B6を連続鋳造圧延した。この際、Al-Ti(5%)-B(1%) の合金ワイヤ23を結晶微細化剤として樋14の溶湯22に供給し、溶湯22中のTi濃度が0.01% になるように供給速度を設定して溶解させた。図９は、凹部30の形状を種々変化させた際の、各鋳造処理量における鋳造板36の表面品質を比較した実験結果を示す図である。実施例１では、流路低面部の流れ方向の前の上端部に切欠を有する凹部を形成した樋を使用して連続鋳造を行った。実施例２では、流れ方向の前及び後上端部に切欠を有する凹部を使用して連続鋳造を行った。比較例１として、切欠部のない凹部を形成した樋を使用して鋳造を行った例を示した。比較例２として凹部が形成されていない、流路底面部が平坦な樋を使用して鋳造を行った例を示した。実施例及び比較例の装置の概略寸法は以下の通りである。

【００１９】

【表１】

| | 流路の深さ | 凹部の深さ | 凹部底部長さ | 前切欠部高さ×幅 | 後切欠部高さ×幅 |
|---|---|---|---|---|---|
| 実施例１ | 30mm | 60mm | 30mm | 20×10mm | − |
| 実施例２ | 30mm | 60mm | 30mm | 20×10mm | 20×10mm |
| 比較例１ | 30mm | 60mm | 30mm | − | − |
| 比較例２ | 30mm | − | − | − | − |

【００２０】鋳造中は樋14の溶湯面レベルをレベル計32で測定し、制御装置34を介して溶解保持炉12の溶解保持炉傾動機24を制御し、溶湯の供給量を一定にした。このように作製したサンプルをコイラー20で巻き取り、切断機38で適宜カットしてサンプルウェブとした。次いで、各サンプルウエブを図５に示す冷間圧延機50で1.5mm厚まで冷間圧延し、図７に示すバッチ式焼鈍装置70によって480 ℃で10時間焼鈍し熱処理を行なった。そして、再度各鋳造板36を図５に示す冷間圧延機50で冷間圧延して0.24mm厚に仕上げた。

【００２１】次に、Ti起因の筋のレベルを確認するため、0.24mm厚に仕上げた各板をアルミン酸ソーダ($Al^{3+}$ 10%:NaOH30%)液を用いて60℃で30秒間のアルカリエッチング処理を行った後、硫酸液でデスマットを行い、硝酸液中でて電気化学的に粗面化した。その状態で各板に筋が発生しているか否かを評価した。この結果、実施例１では処理量400kg までは筋が認められないが（○）、1000kg処理すると、やや筋が認められた（△）。また、流れ方向の後の上端部にも切欠部を有する凹部が形成された樋を使用した実施例２では、いずれの処理量においても筋は認められなかった。切欠部を有さない凹部を有する樋を使用した比較例１では、処理量100kg では筋が認められなかったが、これよりも処理量が多くなると筋が明らかに認められた（×）。また、凹部を有さない樋を使用した比較例２ではいずれの処理量においても筋が明らかに認められた。

【００２２】比較例１及び２の鋳造板36に対してEPMA（電子プローブマイクロアナライザ、日本電子製JXA -8800M）で面分析を行うと、発生した筋には$TiB_2$が偏析していることが確認された。更に、前述の鋳造作業が終了

した後、樋14及び凹部30から溶湯22を排出すると、凹部30に溶湯22の残骸と見られる不純物が存在し、その不純物を分析すると$TiB_2$が高濃度で検出され、粗大な$TiB_2$粒子が凹部に沈降していることを確認した。比較例１では凹部の流れ方向の前の壁面が垂直であるため、この壁面に溶湯がぶつかり、流れに淀みが発生、又はうず流が発生するために、粗大な$TiB_2$（不純物）を十分に沈降できなかったことと、淀みに滞留した$TiB_2$が凝集し、粗大な$TiB_2$粒子を形成したために、筋が発生したと考えられる。この結果から、実施例１及び２の各凹部30の形状は、比較例１の形状の凹部30よりも$TiB_2$粒子が沈降し易いことがわかる。

【００２３】

【発明の効果】本発明は流路の底面に流れ方向の前の上端部、さらに好ましくは後の上端部にも切欠を有する凹部を有するアルミニウム板形成溶連続鋳造圧延装置に関し、この装置を使用してアルミニウム板を形成することにより、溶湯に含まれる粗大な$TiB_2$粒子を鋳造板に混入しないようにできるので、筋のないアルミニウム板を製造することができる。

【図面の簡単な説明】

【図１】本実施の形態の連続鋳造圧延装置の全体構成を示す説明図である。

【図２】図１に示された凹部を形成する樋の一部を示す拡大斜視図である。

【図３】図２に示された樋の一部の正面図である。

【図４】図３の４－４線に沿う断面図である。

【図５】冷間圧延機の説明図である。

【図６】連続焼鈍装置の説明図である。

【図７】バッチ焼鈍装置の説明図である。

【図８】矯正装置の説明図である。

【図９】凹部の形状を変えた際の鋳造板の表面品質を比較した実験結果を示す図である。

【符号の説明】

１０…連続鋳造圧延装置

１２…溶解保持炉

１４…樋

１６…溶湯供給ノズル

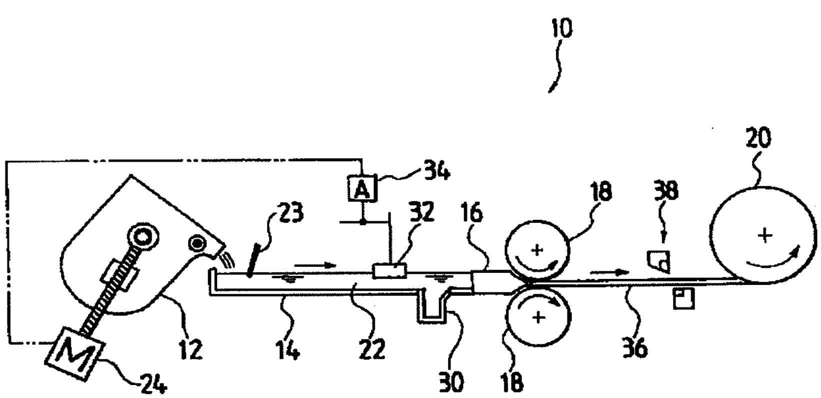
１８…回転ローラ

２２…溶湯

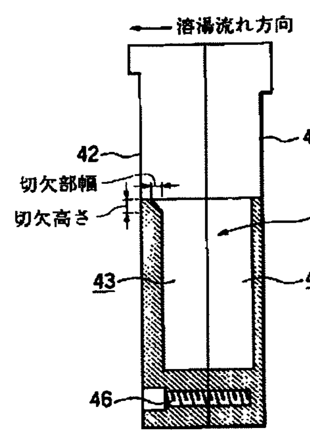
３０…凹部

３６…鋳造板

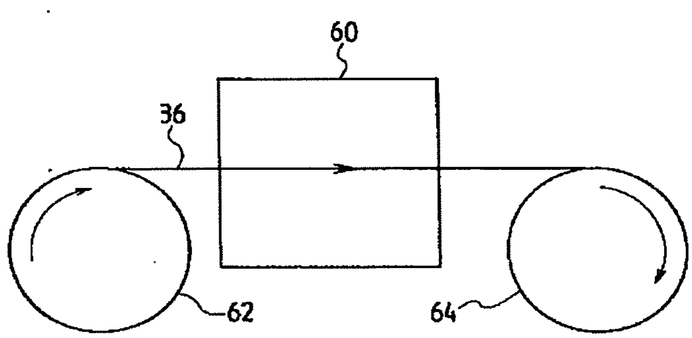
【図１】



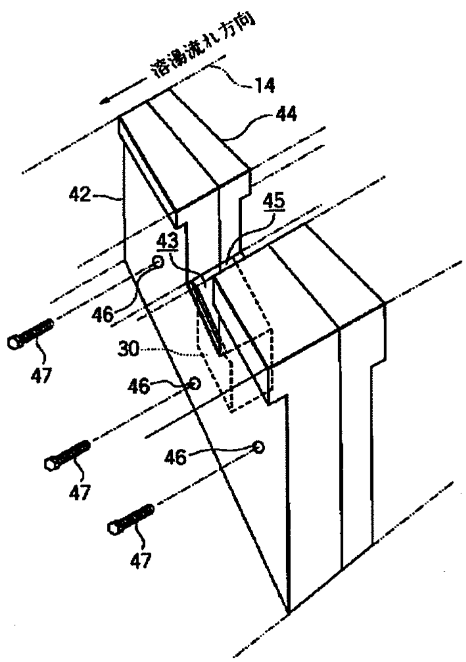

【図４】



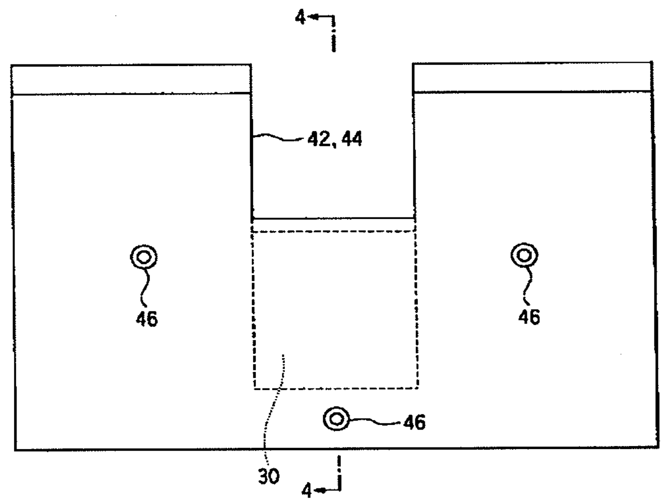

【図６】



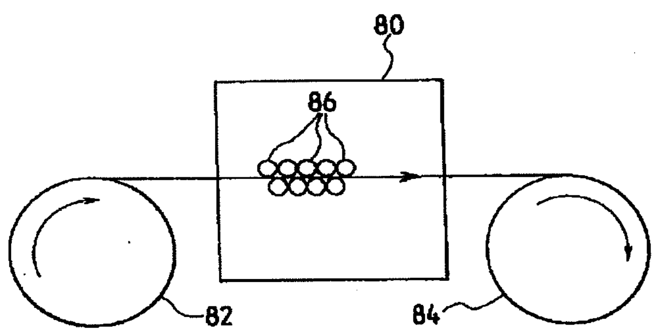
【図２】


溶湯流れ方向
14
44
42
45
43
46
30
47

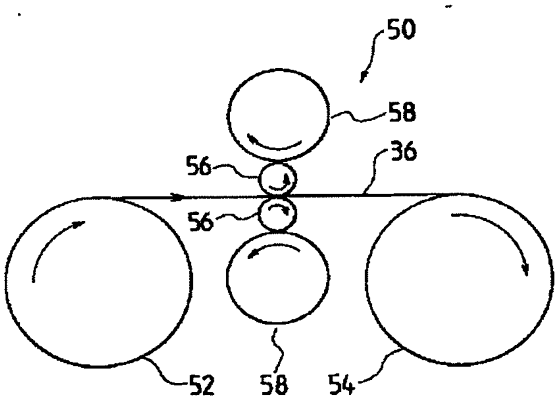

【図３】


4
42, 44
46
30

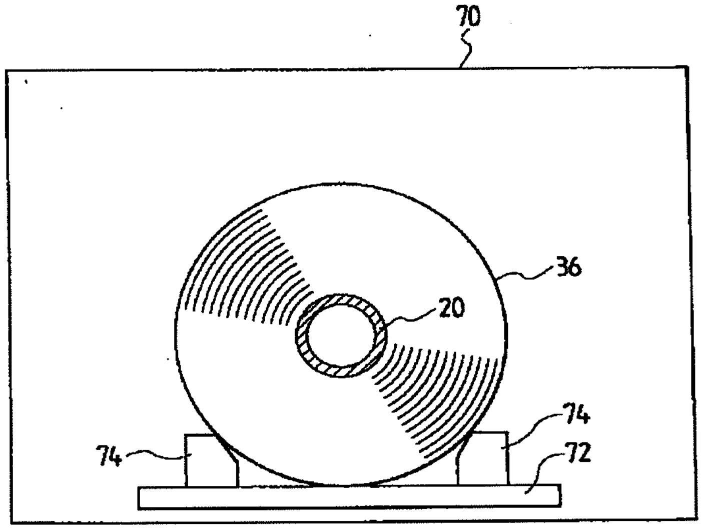

【図８】


80
86
82
84

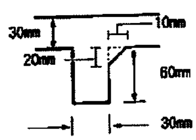
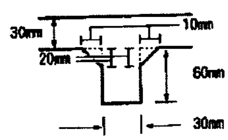
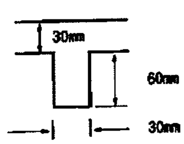

【図５】


50
58
56
36
52
54

【図7】




【図9】

| No | 凹部条件 | 筋発生 100kg | 400kg | 1000kg |
|---|---|---|---|---|
| 実施例1 |   | ○ | ○ | △ |
| 実施例2 |   | ○ | ○ | ○ |
| 比較例1 |   | ○ | × | × |
| 比較例2 |   | × | × | × |

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フロントページの続き

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